1035-39-1302 **Winfried Just*** (just@math.ohiou.edu), Department of Mathematics, Ohio University, Athens, OH 45701, and **German A Enciso** (german.enciso@gmail.com), Harvard Medical School, Department of Systems Biology, 200 Longwood Avenue, Warren Alpert 536, Boston, MA 02115.
Dynamics of cooperative discrete systems. Preliminary report.

We investigate how the assumption of cooperativity influences the dynamics of discrete-time dynamical systems defined on P^n, where $P = \{0, 1, \ldots, p-1\}$. We show that Smale's embedding theorem for continuous systems "almost" applies, in that for sufficiently large p, every dynamical system on P^n can be embedded into a cooperative system on P^{n+2}, but not necessarily into a cooperative system on P^{n+1}. We also investigate which additional assumptions may preclude the existence of exponentially long periodic orbits, which may be taken as an indicator of chaotic dynamics in a discrete system. We show that in analogy to Hirsch's theorem for continuous systems, a suitably defined notion of strong cooperativity in discrete systems precludes such orbits. In contrast, irreducibility of discrete cooperative systems still allows for periodic orbits whose length is of order $p^{n-1}/\sqrt{n}$.

We also study cooperative irreducible Boolean ($p = 2$) systems in which the interaction digraph has in- and outdegree at most two. We show that for any $c < 2$, periodic orbits longer than c^n can occur in such systems, and that for c sufficiently close to 2, systems with such periodic orbits must contain a mechanism similar to a multi-tape Turing machine. (Received September 19, 2007)